1. Find all exponential representations for

$$\text{(a)} \quad (-\sqrt{3} - i)^6 \qquad\qquad\qquad \text{(b)} \quad \frac{(1+i)^{14}(2+2\sqrt{3}i)^4}{4^6 i(1-i)}$$

2. Find exact values for the six sixth roots of $\sqrt{3}-i$. Express final answer in Cartesian form, simplified as much as possible.

3. What is the remainder when $P(x) = (1-2i)x^3 + 3ix^2 + 4x - 2i$ is divided by $2x - 1 + 3i$?

4. Find h and k so that remainders are $1291/2$ and $123/16$ when $x^4 + hx^2 - x + k$ is divided by $x+5$ and $2x-3$, respectively.

5. In each part of this question: (i) use Descartes' rules of signs to state the number of possible positive and negative zeros of the polynomial; (ii) use the bounds theorem to find bounds for zeros of the polynomial; (iii) use the rational root theorem to list all possible rational zeros of the polynomial. Take the results of (a) and (b) into account in (c).

$$\text{(a)} \quad 15x^8 - 2x^4 + 3x - 12 \qquad\qquad \text{(b)} \quad 24x^4 - 13x^3 + 2x^2 - 5x + 21$$

6. In each part of this question, use the procedure of Problem 5 to find all roots of the equation:

$$\text{(a)} \quad 12x^4 + 7x^3 + 2x^2 + 7x - 10 = 0 \quad \text{(b)} \quad x^4 + 2x^3 - 41x^2 - 42x + 360 = 0 \quad \text{(c)} \quad 2x^6 - x^5 + 4x - 2$$

7. Prove that if a_n is greater than $2|a_{n-1}|$, $2|a_{n-2}|$, ..., $2|a_0|$, then every zero of the polynomial $P_n(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x + a_0$ must satisfy

$$|x| < \frac{3}{2}.$$

8. Prove that if $P(x)$ is a polynomial having only even powers of x, and $P(a) = 0$, then $P(x)$ is divisible by $x^2 - a^2$.